



**MONTGOMERY WATSON**

July 10, 1997

Mr. Michael Bellot  
Project Manager  
United States Environmental Protection Agency  
Region 5  
77 West Jackson Boulevard  
Chicago, Illinois 60604-3590

**EPA Region 5 Records Ctr.**



**248044**

Re: Response to Comments  
Final Leachate Collection System Expedited Final Design  
Blackwell Forest Preserve Landfill

Dear Mr. Bellot:

We have received the Agency (U.S. EPA and Illinois EPA) comments letter dated June 16, 1997 for the Final Leachate Collection System (LCS) Expedited Final Design for the Blackwell Forest Preserve Landfill (Landfill, Site) in DuPage County, Illinois. The letter is attached for reference. This response letter will serve as Addendum No. 1 to the Final Design, which addresses the Agencies comments and requests for clarifications. The Agencies' comments have been retyped followed by our responses and/or clarifications.

**COMMENT NO. 1**

It is understood that drawings and details for the leachate extraction wells, lift station pumps, compressor station, foundation slab dimensions, and calculations for sizing the compressor will be supplied as an addendum when the equipment supplier is selected. This addendum must be reviewed before final LCS approval can be granted.

**Response**

Montgomery Watson is currently working with the selected subcontractor(s) to expedite the submittal of the aforementioned shop drawings and installation details. This information will be forwarded to the Agencies when received, for Agency review prior to construction of these elements.

**COMMENT NO. 2**

The Operation and Maintenance Plan (O&M Plan) includes fundamental design criteria for the transition from active to passive gas extraction and construction of the flaring apparatus. For this reason, a complete review of the O&M plan is also required prior to final approval.

**Response**

The draft O&M Plan is currently being developed for Agencies' review and comment. The draft O&M Plan will be prepared to meet the requirements set forth in the U.S. EPA Administrative Order by Consent (AOC) and Statement of Work (SOW) Docket No. V-W-96-C-341 issued to the Forest Preserve District (FPD). The draft O&M Plan will only provide the information necessary to perform O&M and monitoring of the implemented response actions at the Site. Much of the information that is required in the O&M Plan will not be developed or refined until construction is approximately 85% complete. Therefore, the draft O&M Plan, to be submitted under separate cover, will discuss the O&M in general terms. Detailed procedures and information for long term O&M will be included in the final O&M plan, to be submitted prior to the Prefinal Inspection.

The response actions are defined as the following six remedial systems:

1. General O&M Activities
2. Landfill Cap
3. Leachate Collection System (LCS)
4. Landfill Gas (LFG) Venting System
5. Groundwater Monitoring Systems

Each remedial system component will be discussed in terms of the following elements, as applicable:

- Normal O&M
- Potential Operating Problems
- Routine Monitoring and Laboratory Testing
- Alternate O&M
- Corrective Action

Record construction drawings will be developed after construction is complete, and will be provided as an Addendum to the final O&M Plan.

**COMMENT NO. 3**

Detail 2 in Drawing D3 shows the landfill gas vent pipe. Support calculations for the concrete pad and concrete footing shown should be provided for completeness. In addition, a note should be added to Detail 2 to clarify whether the concrete pad and concrete footing are connected as shown and, if they are, to provide a specification for the connection.

**Response**

Details and calculations for the cast-in-place concrete are being developed using information to be supplied by the subcontractor. This information will be forwarded to the Agencies when completed, for review prior to construction of the vent stack pad.

**COMMENT NO. 4**

The design criteria for the negative pressure calculation in Appendix D2 indicate that the gas flow rate for each extraction well is 10 cubic feet per minute (cfm). The total maximum system gas flow is 100 cfm, and the vacuum required at extraction well EW08 is 15 inches of water column. Please provide justification for selecting these values for design purposes. According to the response to Specific Comment 2, an active gas collection system will be required if it is determined that uncontrolled gas emissions are occurring through or around the cap. If an active system is necessary, the design gas extraction flow rate and vacuum required will be based on the rate of gas generation and the capture zone necessary to control off-site gas migration. On-site tests using the existing gas extraction wells may be needed to establish design criteria to properly size the blower. Appendix D2 should present the design criteria and indicate that these criteria will need refinement to properly design an active system.

**Response**

Design criteria, and proposed refinement based on operational data gathered after start-up of the system, are discussed in revised Appendix D2, attached.

**COMMENT NO. 5**

Page 11 of the responses states that Montgomery Watson will perform construction quality assurance activities and that an independent third party will perform quality control activities. Appendix F, Section 3.4, Page 3-3 should identify the independent third party.

**Response**

The independent third party will be Testing Services Corporation (TSC), who will be responsible for in-place density testing, geotechnical testing, and soils classification in accordance with the Specifications. The revised Appendix F, Section 3.4, Page 3-3 is attached.

**WEST STORM WATER PIPE/NORTH COLLECTOR PIPE RESPONSE**

The existing west storm water pipe will be left in place. The north perforated PVC collector pipe will be connected to the LCS, as requested by U.S. EPA. Appropriate soil samples will be collected in the woods, at the discharge point.

As indicated, additional information will be sent to the Agencies for review, as we receive this information from the subcontractors. Please call Tom Blair, or myself, if you have any questions regarding this response letter, or Addendum No. 1 to the final LCS Expedited Final Design.

Sincerely,

MONTGOMERY WATSON

Walter Buettner, P.E.  
Project Manager

Enclosures: June 16, 1997 U.S. EPA letter  
Negative Pressure Requirements Design Calculation (Rev. 1)  
Appendix F, Section 3.4, Page 3-3 (Rev. 1)

cc: Mr. Rick Lanham - IEPA  
Mr. Jerry Hartwig - FPD  
Mr. Peter Vagt - Montgomery Watson  
Mr. Kostas Dovantzis - PRC

DRI ndp TB PJV  
J 1252 008 04 WP1 TR 88 B111 O DOC  
1242008 04090050-MD

**JUNE 16, 1997 U.S. EPA LETTER**



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 5  
77 WEST JACKSON BOULEVARD  
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF.

SR-6J

June 16, 1997  
DCL0970

Mr. Joseph Benedict  
Forest Preserve District of DuPage County  
P.O. Box 2339  
Glen Ellyn, IL 60138

RE: Leachate Collection System Expedited Final Design

Dear Mr. Benedict:

Thank you for submittal of the revised document entitled *Final Leachate Collection System Expedited Final Design, Blackwell Forest Preserve Landfill*, dated May, 1997.

The United States Environmental Protection Agency (USEPA) and the Illinois Environmental Protection Agency (IEPA) have reviewed this document in light of our April 4, 1997 comment letter. This review indicates that the majority of our comments were adequately addressed and incorporated into the revised final design. For this reason, we are granting interim document approval. However, there are a few minor clarifications summarized below that need to be addressed before final approval will be granted and construction can begin.

- It is understood that drawings and details for the leachate extraction wells, lift station pumps, compressor station, foundation slab dimensions, and calculations for sizing the compressor will be supplied as an addendum when the equipment supplier is selected. This addendum must be reviewed before final LCS approval can be granted.
- The Operation and Maintenance Plan (O&M Plan) includes fundamental design criteria for the transition from active to passive gas extraction and construction of the flaring apparatus. For this reason, a complete review of the O&M plan is also required prior to final approval.
- Detail 2 in Drawing D3 shows the landfill gas vent pipe. Support calculations for the concrete pad and concrete footing shown should be provided for completeness. In addition, a note should be added to Detail 2 to clarify whether the concrete pad and concrete footing are connected as shown and, if they are, to provide a specification for the connection.

- The design criteria for the negative pressure calculation in Appendix D2 indicate that the gas flow rate for each extraction well is 10 cubic feet per minute (cfm). The total maximum system gas flow is 100 cfm, and the vacuum required at extraction well EW08 is 15 inches of water column. Please provide justification for selecting these values for design purposes. According to the response to Specific Comment 2, an active gas collection system will be required if it is determined that uncontrolled gas emissions are occurring through or around the cap. If an active system is necessary, the design gas extraction flow rate and vacuum required will be based on the rate of gas generation and the capture zone necessary to control off-site gas migration. On-site tests using the existing gas extraction wells may be needed to establish design criteria to properly size the blower. Appendix D2 should present the design criteria and indicate that these criteria will need refinement to properly design an active system.
- Page 11 of the responses states that Montgomery Watson will perform construction quality assurance activities and that an independent third party will perform quality control activities. Appendix F, Section 3.4, Page 3-3 should identify the independent third party.

Finally, with regard to the pipe that passes under the north part of the landfill. Based on the photos provided in the letter from MW dated May 15, 1997, it appears that the West Stormwater Pipe (as shown in photo 1) is designed for the transport of surface water from storm events (based on its shallow placement and no apparent perforations in the pipe). However, the North Collector Pipe (as shown in photo 4), appears to be a completely perforated PVC pipe located at the bottom of a deep trench (appears 6 to 8 feet deep in photo 5). This appears more consistent with subsurface liquid capture (i.e., leachate) rather than stormwater transport. For this reason, the perforated PVC pipe beneath the north portion of the landfill should be connected to the leachate system and not allowed to discharge to the woods. Further, if the recent sample indicates the presence of contaminants, appropriate soil sampling will be required at the discharge point in the woods.

Once the appropriate documents have been submitted and approved, and the minor changes above are made, we will issue formal approval. In order to minimize reproduction, please submit only the required replacement pages with the holes pre-punched so we can just replace the pages. If you have questions regarding this letter, or would like to discuss any of these comments in greater detail, please contact me at (312) 353-6425 and we can set up a conference call with Rick Lanham of IEPA.

Sincerely,



Michael E. Bellot  
EPA Remedial Project Manager

cc: Rick Lanham, IEPA  
Jerry Hartwig, FPD  
Peter Vagt, MW  
Kostas Dovantzis, PRC

D2

NEGATIVE PRESSURES REQUIREMENTS  
CALCULATION  
REVISION No. 1  
(PUNCHED FOR INSERT INTO FINAL LCS  
EXPEDITED FINAL DESIGN)



**NEGATIVE PRESSURE REQUIREMENTS CALCULATION  
REVISION NO. 1  
BLACKWELL LANDFILL SITE**

The following calculation estimates the total negative pressure (vacuum) requirements of the potential active LFG extraction system. The vacuum requirement is the amount of vacuum that must be applied to the LFG control system wellfield to properly extract the available LFG and reduce LFG migration.

In the event that the Blackwell Landfill may utilize active LFG extraction in the future, a blower system would be located near the northwest corner of the site. The LFG main header pipe is designed as a single branch configuration with well EW08 located at the system extremity. Six of the total nine wells (EW01A, 02, 04, 05, 06, and 08) are considered directly connected to the main LFG header pipe. The 3 remaining wells (EW01, 03, 07) are connected to the main header pipe using lateral header pipes.

The vacuum requirement is calculated based on the headlosses estimated for each section of header pipe along the critical main header branch. "Critical" typically defines the branch that realizes the greatest headloss since it carries the most flow and includes the majority of the piping and fittings. For the Blackwell Landfill header pipe system, the critical path has been selected as beginning at well EW08 and following the flow path past wells EW06, EW05, EW04, EW02, and EW01A flowing toward dripleg DL02 (900 total feet).

In a typical LFG header pipe segment, the LFG extracted from a well is directed through the wellhead, through the header riser, and through the LFG header pipe as it proceeds to the blower. At each well and lateral header connection along the way, additional LFG flow is contributed to the main header. All pipe lengths and fittings contribute headlosses during LFG extraction system operation.

These calculations assume that there are 6 LFG header pipe segments that make up the critical flow path. The lateral connections and their flow contributions are not modeled as additional pipe segments. The losses due to the laterals are accounted for within the critical header segment modeled. A header pipe segment flow of 100 cfm is modeled as the average maximum flow expected throughout the critical flow path.

#### **Gas Flow**

A flow of 100 cfm was selected based on experience with landfills of similar size and age of waste. The flow is used to calculate the headlosses in the gas conveyance pipe system which are then used to size system components including the conveyance pipes, driplegs, blowers, and flares.

The gas header pipe has been selected to be nominal 6-in. diameter HDPE pipe with an approximate inside diameter of 5.8 in. The general design constraint is that the maximum allowable headloss in the gas header pipe should be less than 1 in. water column (WC) for every 100 lin. ft of pipe. In 100 lin. ft. of 6-in. diameter HDPE pipe a headloss of 1.011 in. WC is produced at a flow of 360 cfm (see output file: test4.out). Total flow greater than 360 cfm is not expected from the landfill. Greater flows can be conveyed through 6-in. HDPE header pipe but the greater headlosses would need to be considered when sizing the blower equipment. Refer to attached sheets 9 and 10 for the "Headloss" computer program input and output files. The gas temperature was conservatively selected as 70°F.

The driplegs have been designed with 50% additional capacity for higher than expected system vacuum pressures. Refer to D3 of the Design Calculations in Appendix D.

If active gas extraction is determined necessary, sizing and selection calculations would be performed for the blower and flare system. The calculations would take into account all site operational data including an estimated gas generation rate, the anticipated radius of influence of a typical extraction well, and other pertinent and available site-specific information. Gas extraction well pump tests will be performed on some of the wells in order to further refine the design criteria to make proper blower and flare selections if necessary.

#### Design Criteria

- Each gas extraction well will provide 10 cfm LFG for a 9-well total of 90 cfm maximum system flow (Use 100 cfm). This is a conservative estimate based on experience and known site conditions.
- The LFG header pipe is standard dimension ratio (SDR) 17 high-density polyethylene (HDPE) pipe. The inside cross-sectional area of 6-in. diameter SDR17 HDPE pipe is 0.183 sq. ft based on an actual inside diameter of 5.8 in. The inside diameter of 4-in. HDPE pipe is 3.955 in. (rounded to 4 in.), which results in a cross-sectional area of 0.087 sq. ft. Pipe friction losses are assumed negligible for the pipe and connection methods used (i.e., butt-fusion).
- The vacuum required at the furthest well (EW08) is -15.0 in. WC, which includes the well piping headlosses. A vacuum pressure of 15 in. WC has been selected based on experience with landfills of similar size and age of waste. The headlosses generated by wellhead pipe and fittings are generally less than 1 in. WC (see output file: black.out). Typically, wells can achieve their maximum radius of influence with an applied vacuum of 5 to 10 in. WC vacuum. Since information of actual subsurface conditions is limited, a design vacuum of 15 in. WC was selected for required available vacuum at

**the furthest well of the extraction system.** Refer to the layout Drawing D1 for the well location.

- The LFG temperature is assumed to be 70°F, which is a conservative value for the pipe sizing calculation

### **Calculations**

Lengths and equivalent lengths of pipe were estimated using the tables and charts attached as sheets 7 and 8 of 10. Pipe sizes are all 6-in. diameter HDPE pipe. The headlosses are calculated using the "Headloss" program described below. For estimating headlosses in each pipe segment along the critical path, exact pipe lengths and fittings from EW01A to DL02 are counted for their respective contribution to headloss. The calculated headloss from this worst-case segment of the critical flow path was multiplied by six to account for each segment along the critical path. Refer to attached sheet 4 of 10 for the lengths and equivalent lengths estimated.

### **"Headloss" Model**

The computer model "Headloss" is used to calculate headlosses within selected pipe segments based on LFG temperature, length of pipe, equivalent length of pipe connection fittings, inside pipe diameter, pipe material, and the LFG flow rate. The model selects the friction factor for the pipe and calculates the total headloss for the selected pipe segment. The Darcy-Weisbach equation is used along with the Moody friction factor.

### **Conclusion**

The "Headloss" program input file is provided on attached sheet 5 of 10. The output file is attached sheet 6 of 10. The headloss in a typical header pipe segment is -0.928 in. WC. The total negative pressure (vacuum) requirement is summarized as follows:

- -15.0 in. WC = Vacuum required at well EW08
- -5.63 in. WC = 6 segments' total headloss (-0.938 x 6 segments)
- -20.63 in. WC = Total Negative Pressure Required

**Conclude that total negative pressure required is -21.0 in. WC and the driplegs must be sized to handle the calculated vacuum pressures at a minimum.**

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1252008.04090050-MD

**SUMMARY OF LENGTHS AND EQUIVALENT LENGTHS  
AND MODELED PARAMETERS FOR CRITICAL PATH**

**BLACKWELL LANDFILL SITE**

<b>Typical Header Section</b>	<b>Pipe Description</b>	<b>Length or Equivalent (ft)</b>	<b>Drawing Reference No.</b>
<u>Well to Well</u>	Wellhead (15.0 in. W.C. required)	--	D1
	6-in. dia. gas header riser	5 (L)	D2
	6-in. dia. 45° elbow	7 (EL)	D2
	6-in dia. wye (branch flow)	30 (EL)	D2
	6-in. dia. gas header pipe to next well	900 (L)	D2
	6-in. dia. tee (run flow at 4-in. lateral connection)	10 (EL)	D2

Total Length (L)= **905 ft**

Total Equivalent Length (EL)= **47 ft**

Flow through modeled header= **100 cfm**

**NOTES:**

1. LFG extracted from a well is directed through the wellhead, the header riser fittings, the header pipe to the next well, and may pick up flow from a 4-in. header lateral along the way (see above).
2. 900 ft was selected as a conservative max. length of LFG header pipe between wells.
3. 100 cfm flow selected as modeled flow since it is the average maximum for entire critical flow path.
4. Six LFG header pipe segments are assumed for the critical flow path.
5. Losses due to lateral header connections to the main LFG header, including the flow contributions, are accounted for within the typical header segment modeled above.

# INPUT FILE

P. 5 of 10

C:\>headloss

IS DATA BEING ENTERED FROM THE KEYBOARD OR A FILE?

ENTER "1" FOR KEYBOARD OR "2" FOR A FILE

1

ENTER PIPE LENGTH IN FEET:

905

ENTER THE EQUIVALENT LENGTH FOR FITTINGS IN FEET:

47

ENTER PIPE DIAMETER IN INCHES:

5.8

ENTER THE TYPE OF PIPE:

1=PVC 2=HDPE

2

ENTER TYPE OF PIPE OR FITTING:

typical

ENTER PIPE INLET FLOW RATE IN SCFM:

100

ENTER PIPE INLET GAGE PRESSURE IN INCHES OF H2O:

0

ENTER THE GAS TEMPERATURE (DEG. F)

70

ENTER NUMBER OF STEPS FOR CALCULATION:

10

ENTER OUTPUT FILE NAME:

black.out

OUTPUT FILE

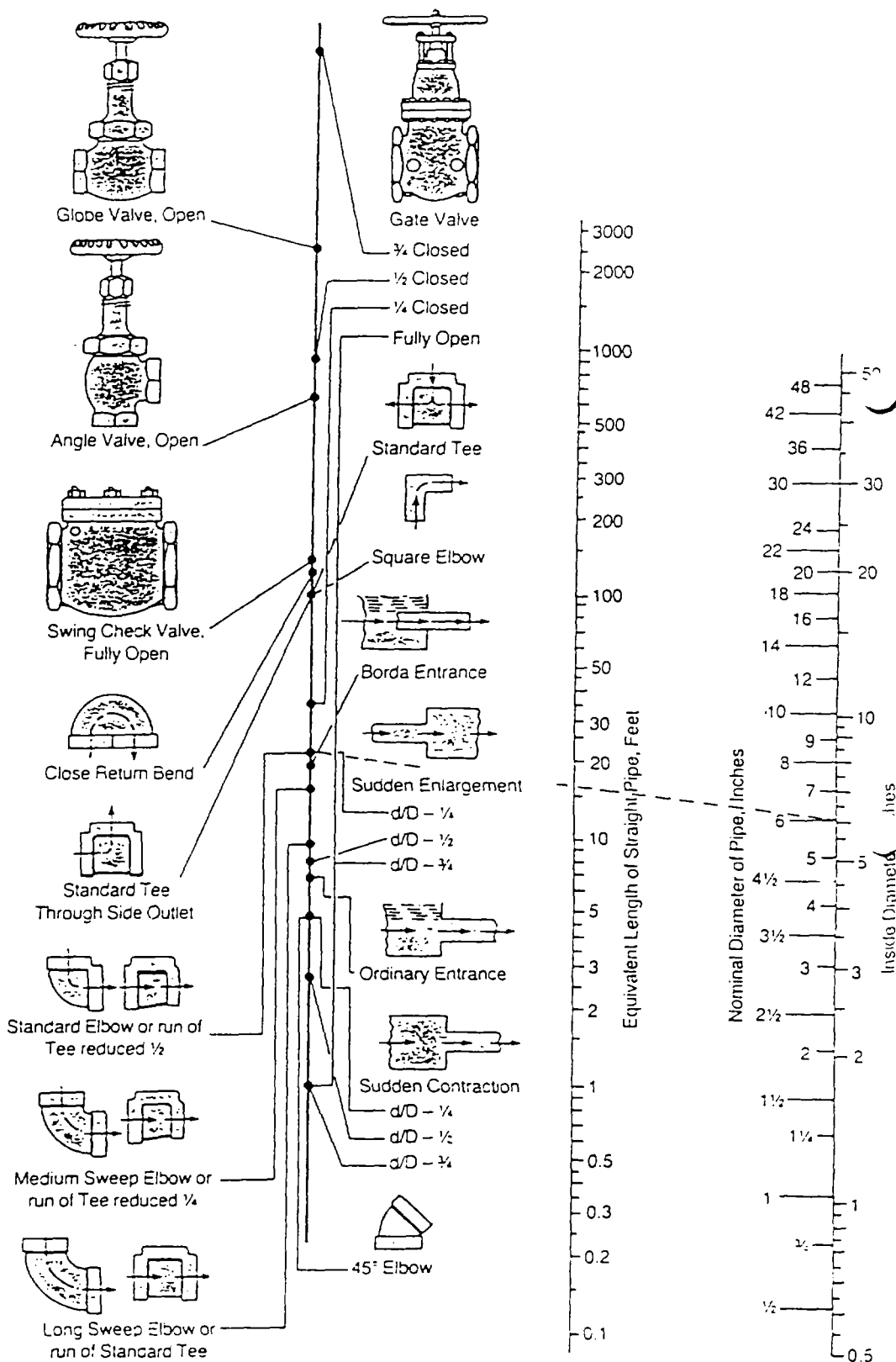
```
C:\>type black.out
THE NO. OF PIPES FOR THIS CALCULATION IS: 1
THE STARTING PRESSURE = .000 INCHES OF H2O GAGE
THE GAS TEMPERATURE = 70.0 DEG. F
PIPE DATA =====>
TYPE OF PIPE OR FITTING: typical
LENGTH = 905.0 FT.
EQUIV. LENGTH OF FITTINGS = 47.0 FT.
DIAM = 5.8 IN.
EPS = .000070 FT.
INLET FLOW = 100.0 SCFM
NSTEPS = 10
THE HEADLOSS FOR PIPE NO. 1 = .938 IN. OF H2O
THE PRES. AT THE END OF PIPE NO. 1 = -.938 IN. OF H2O GAGE
*****
TOTAL HEADLOSS = .938 IN. OF H2O

C:\>
```

## Resistance of Valves and Fittings to Flow of Fluids

Example: The dashed line shows that the resistance of a 6-in. standard elbow is equivalent to approximately 16 ft of 6-in. standard pipe.







Note: For sudden enlargements or sudden contractions, use the smaller diameter,  $d$  on the pipe-size scale. Head loss through check valves varies with types manufactured. Consult with manufacturer for correct values.



**Fitting Pressure Drop:** Listed below in Chart 5 are various common piping system components and the associated pressure loss through the fitting expressed as an equivalent length of straight pipe in terms of diameters. The inside diameter (in feet) multiplied by the equivalent length diameters gives the equivalent length (in feet) of pipe. This equivalent length of pipe is added to the total footage of the piping system when calculating the total system pressure drop.

These equivalent lengths should be considered an approximation suitable for most installations.

**Chart 5**

<b>Fabricated Fitting</b>		<b>Equiv. Length</b>
Running Tee . . . . .		20 D
Branch Tee . . . . .		50 D
90° Fab, Ell . . . . .		30 D
60° Fab, Ell . . . . .		25 D
45° Fab, Ell . . . . .		18 D
45° Fab, Wye . . . . .		60 D
Conventional Globe Valve (Full Open) . . . . .		350 D
Conventional Angle Valve (Full Open) . . . . .		180 D
Conventional Wedge Gate Valve (Full Open) . . . . .		15 D
Butterfly Valve (Full Open) . . . . .		40 D
Conventional Swing Check Valve . . . . .		100D

(See Appendix for further data on resistance of valves and fittings to flow).



INPUT FILE (PIPE SIZE CHECK)

p. 9 of 10

```
C:\>headloss
IS DATA BEING ENTERED FROM THE KEYBOARD OR A FILE?
ENTER "1" FOR KEYBOARD OR "2" FOR A FILE
1
ENTER PIPE LENGTH IN FEET:
100
ENTER THE EQUIVALENT LENGTH FOR FITTINGS IN FEET:
0
ENTER PIPE DIAMETER IN INCHES:
5.8
ENTER THE TYPE OF PIPE:
1=PVC 2=HDPE
2
ENTER TYPE OF PIPE OR FITTING:
test4
ENTER PIPE INLET FLOW RATE IN SCFM:
360
ENTER PIPE INLET GAGE PRESSURE IN INCHES OF H2O:
0
ENTER THE GAS TEMPERATURE (DEG. F)
70
ENTER NUMBER OF STEPS FOR CALCULATION:
ENTER OUTPUT FILE NAME:
test4.out
```

70  
 ENTER NUMBER OF STEPS FOR CALCULATION:  
 10  
 ENTER OUTPUT FILE NAME:  
 test4.out  
 Stop - Program terminated.

C:\>type test4.out  
 THE NO. OF PIPES FOR THIS CALCULATION IS: 1  
 THE STARTING PRESSURE = .000 INCHES OF H2O GAGE  
 THE GAS TEMPERATURE = 70.0 DEG. F  
 PIPE DATA =====>  
 TYPE OF PIPE OR FITTING: test4  
 LENGTH = 100.0 FT.  
 EQUIV. LENGTH OF FITTINGS = .0 FT.  
 DIAM = 5.8 IN.  
 EPS = .000070 FT.  
 INLET FLOW = 360.0 SCFM  
 NSTEPS = 10  
 THE HEADLOSS FOR PIPE NO. 1 = 1.011 IN. OF H2O  
 THE PRES. AT THE END OF PIPE NO. 1 = -1.011 IN. OF H2O GAGE  
 \*\*\*\*\*  
 THE TOTAL HEADLOSS = 1.011 IN. OF H2O

C:\>

APPENDIX F, SECTION 3.4, PAGE 3-3  
REVISION 1  
(PUNCHED FOR INSERT INTO FINAL LCS  
EXPEDITED FINAL DESIGN)

- Authorship, review, and approval of text and graphics required for field team efforts.
- Coordination and oversight of technical efforts of subcontractors assisting the field team.
- Identification of problems at the field team level, discussion of resolutions with the site manager, and provision of communication between team and upper management.
- Participation in the preparation of draft and final reports.

### **3.3.3 Montgomery Watson Quality Assurance Officer**

The Montgomery Watson Quality Assurance Officer (QAO) is Mr. Walter Buettner. The QAO will remain independent of direct job involvement and day-to-day operations, and has direct access to corporate executive staff as necessary to resolve any QA dispute. He is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, Montgomery Watson's policies, and state requirements. Specific functions and duties include:

- Provide QA audit on various phases of the field operations.
- Review and approval of QA plans and procedures.
- Providing QA technical assistance to project staff.

The Montgomery Watson Field Team Leader is responsible for field QA/QC and will communicate with technical staff accordingly.

### **3.3.4 Technical Staff**

The technical lead staff for this project is Mr. Dean Free. Additional technical support including that for construction for this project will be drawn from Montgomery Watson's pool of corporate resources. The technical staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical - staff are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

## **3.4 SPECIALIZED RESPONSIBILITIES**

Monitoring and sampling operations and QC responsibilities will be managed as follows:

- Sampling, Monitoring, and Survey - Montgomery Watson
- On-site day-to-day field activities - Field Team Leader, Montgomery Watson
- Quality Control - Testing Services Corporation, subcontracted by Montgomery Watson
- Technical LCS Design Issues - Technical Lead Staff, Montgomery Watson